

Intellectual Capital

Outline of Efforts to Strengthen Intellectual Capital

To continue providing value to society in a turbulent era, we must understand the true needs of our customers and leverage our technological capabilities to offer them value that is ahead of its time. During a history of more than 70 years, we have driven business growth by extending the scope of our product R&D from the mechanical parts field to encompass electronics and software.

We will establish competitive advantages not only through mass production development but also through R&D that anticipates long-term changes in social conditions and technology trends and utilizes leading-edge technologies in such fields as semiconductors, materials, AI, and ergonomics. Moreover, DENSO will increase its competitive advantages by advancing intellectual property (IP)-focused management that is fully integrated with business strategies.

KPI Targets for Fiscal 2026

R&D expenditure **¥450.0 billion**

Including portion of asset capitalization and recovery of development expenditures

Business Portfolio Reform Aimed at the Ultimate Goal of “Zero”

Ten years ago, our business portfolio reflected market demand and consisted mainly of internal combustion engine products and conventional air conditioner products. Recently, however, this business portfolio has been undergoing major reforms. In fiscal 2023, electric vehicle components, advanced driver assistance systems (ADAS), and products of other growth businesses accounted for approximately 70% of overall revenue. Our goal is for growth businesses to double their revenue by 2035 and thereby drive the increase in our corporate value. Meanwhile, our de-emphasis and discontinuation of internal combustion engine products will roughly half revenue from these products by 2035. Further, we are pursuing R&D with the aims of medium- to long-term business expansion and commercialization in non-automotive fields and other new business fields related to the connections between five essential elements, which are explained in greater detail later in this section. Through these business portfolio reforms, DENSO aims to realize carbon-neutral *Monozukuri* and eliminate traffic accident fatalities.

We have also begun to reform our business model based on medium- to long-term changes in the business environment. As well as offering conventional tangible value realized through hardware, we will respond to the increased rollout of software-defined vehicles (SDVs) by emphasizing intangible value created through software development. In this way, we will heighten our competitiveness even further.

Transition Strategy for the Realization of Business Portfolio Reform

In building the ideal business portfolio for the future, we have set out strategies for each product category based on the key goals of realizing our philosophy, accelerating our growth, and boosting our profitability in terms of return on invested capital (ROIC). To realize these strategies, we are optimally allocating resources and conducting efficient R&D.

In addition, our establishment of R&D capabilities in seven regions worldwide is enabling us to acquire talented engineers in each region and advance innovation based on regional characteristics and advantages.

While we are dedicated to improving in-house technologies even further, we are actively participating in a multifaceted range of partnerships and rulemaking initiatives through alliances, M&As, industry–government–academia collaborations, and technical liaisons. (Financial Capital [P.71](#))

Characteristics of DENSO's Intellectual Capital (Fiscal 2023 results)

R&D expenditure (ratio to revenue)

¥521.6 billion (8.1%)

Including portion of asset capitalization but excluding recovery of development expenditures

Number of patent applications filed

Approx. 3,500

Number of patents held

Approx. 41,000

In-Vehicle Semiconductors—Helping Maximize the Value of Green and Peace of Mind

In-vehicle semiconductors are playing increasingly important roles in the popularization of electric vehicles and automated driving. We will engage in the dynamic, strategic development of these products by utilizing strengths cultivated during more than half a century of semiconductor research and by leveraging alliances.

In the sensors field, we have strengthened our in-house R&D organization and formed strong development partnerships with highly specialized vendors of semiconductors. As for the field of microcontrollers, systems-on-chips (SoCs), and other logic semiconductors—which are indispensable for heightening the performance of vehicle control systems such as ADAS—we are strengthening partnerships with specialized manufacturers so that we can utilize the latest advances in consumer technologies and establish capabilities for the leading-edge development and stable procurement of high-quality in-vehicle semiconductors. Similarly, in the field of power semiconductors we are meeting the rapidly growing demand for electric vehicle components by continuing to bolster in-house manufacturing capabilities while building partnerships that solidify the foundations of our competitiveness and supply capabilities.

Growing Importance of Software

Recent years have seen the dawning of an era in which software adds new value to vehicles. Software is essential for the automated driving, BEV motor control, and energy management systems that are enabled by sensors, algorithms, and AI as well as for functions that facilitate the downloading of upgraded software from cloud computing services in the same manner as smartphone systems are upgraded. As a result, software development is expected to account for 50% of vehicle development by 2030, compared with a level of roughly 20% in 2000.

Anticipating this shift, we are strengthening R&D and personnel training in the software field. (Message from the Chief Software Officer [P.85](#))

Strengthening Capital to Grow Businesses and Address Social Issues

Over its long history, DENSO has acquired manufacturing with high levels of efficiency and quality, robust business foundations, advanced R&D, and three-pronged solution capabilities. Forged through years of business with our customers, these strengths cannot be easily replicated. Our strengths enable us

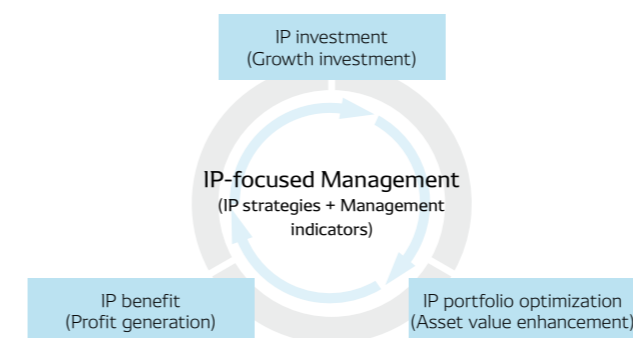
to go beyond manufacturing that focuses on components in isolation and create truly valuable products and systems as a comprehensive system supplier.

DENSO aims to address social issues and realize new value creation, profit growth, and capital cost reduction that enhance corporate value. To these ends, the Company will pursue a range of initiatives. We will advance initiatives to create world-best and world-first products through leading-edge technology research. The Company will also implement initiatives to increase sales in the connected, autonomous, shared & service, and electric (CASE) vehicle field by investing in and deploying personnel to growth fields. Other initiatives will focus on establishing competitive advantages inside and outside the automotive industry by increasing the creation of patents that can be utilized by other companies.

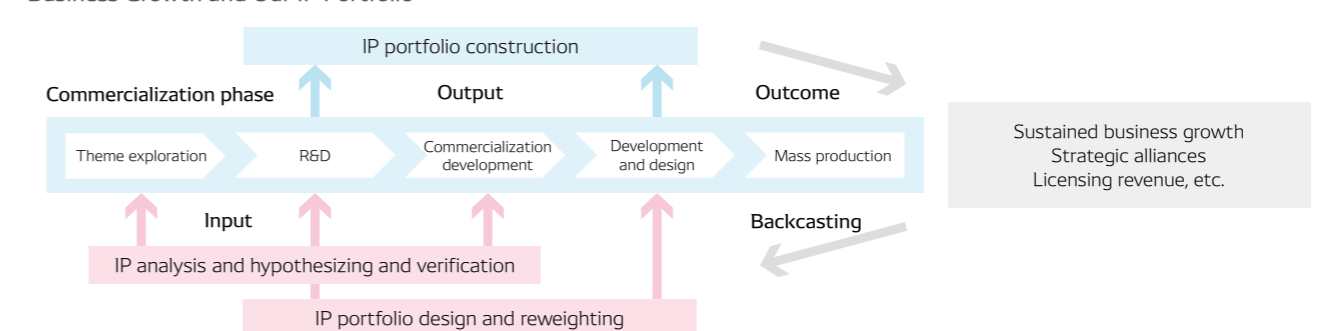
In addition, by utilizing an “ROIC tree” in-house, we are able to visualize how the intellectual capital-strengthening activities and KPIs of individuals and departments are connected to improved development efficiency, new product launches, new sales expansion, and improved ROIC. Also, we are improving development efficiency—especially in software development, which requires many man-hours—by automating testing processes to shorten the development lead times. As a result, we have achieved efficiency improvement benefits that are more than twice the amount invested. Thus, we are implementing rigorous countermeasures to heighten our competitiveness even further. (Financial Capital [P.67](#))

From IP Strategies to IP-focused Management

In addition to the IP strategies that DENSO has advanced for individual businesses and products, the Company is strengthening IP portfolio management by redefining the IP portfolio as an asset that is indispensable to the Company's sustained growth. In advancing these activities, our management, business, R&D,



Business Growth and Our IP Portfolio



and IP divisions are holding dialogues to further bolster a cycle of IP asset value enhancement, profit generation, and investment in growth as well as to elevate our IP strategies to the level of IP-focused management that benefits corporate management.

IP Portfolio Design Activities Aimed at Enhancing Corporate Value and Sustaining Growth

As the added value of automobiles changes, we will focus on R&D in growth fields and new fields. In this way, we will steadily accumulate IP in these fields, which will serve as the foundations of future businesses. In addition, while identifying a value creation story and core technologies that help to address social issues, we have backcast from our DENSO R&D Policy Guideline to design a target profile for our IP portfolio. To realize this profile, we are both adding and removing IP from the portfolio.

In designing our Companywide IP portfolio, we have divided it into three levels: a Companywide level, a business level, and a development theme level. Based on a target profile for each level, we will add and remove IP. When replacing IP in this way, we are utilizing three new indicators. A leading indicator mainly emphasizes such new fields as Mobility as a Service (MaaS) and agricultural technology (AgTech) and shows trends in our future IP portfolio. In addition, a current indicator is primarily focused on battery electric vehicles (BEVs), ADAS, and other growth fields and measures the strength of our present IP portfolio. Meanwhile, a lagging indicator mainly reflects fields related to the de-emphasis and discontinuation of internal combustion engine products and shows the track record of our established IP portfolio. Based on these indicators and in step with product life cycles, we are pursuing IP investment that contributes to the strengthening of IP competitiveness and the realization of our future vision.

With respect to the aforementioned development theme level, at the stages beginning from the exploration of commercialization themes through to commercialization development, we will analyze vast amounts of IP information, including the patents of other companies, and establish and verify hypotheses in a timely manner. These efforts will allow us to provide input that contribute to product development activities. For example, we will clarify core technologies that both underpin competitiveness and help to address social issues. Through these activities, we will ensure that our achievements lead to IP rights that become company assets. We will enhance corporate value and sustain growth by advancing timely efforts aimed at maintaining price competitiveness through differentiation, building business ecosystems through strategic alliances based on IP, and obtaining licensing revenue in “open” fields through an “open/close” strategy.

Long-term R&D and IP Strategy with a View to 2035

In recent years, pandemics, conflicts, and logistics disruptions have brought the movement of people and goods to a halt around the world, stagnating social and economic activities and forcing changes in social behavior. Meanwhile, coupled with technological innovations in AI, IT, and semiconductors, the automotive industry is undergoing dramatic structural change, and business conditions remain intensely competitive.

In this chaotic world, DENSO has hosted a series of discussions with internal and external experts to reexamine its overall direction as well as the kind of society the Company should help realize. As a result of these efforts, in fiscal 2023 we formulated our DENSO R&D Policy Guideline, which is based on five essential elements: the free movement of people, the flow of goods, energy utilization, minimization of resource requirements, and the flow of data.

Serving as a compass for Companywide R&D, the outline sets out a scenario divided into 10-year phases, which is aimed at continued realization of customer value and sustained business growth. Based on the green and peace of mind principles set forth in the Long-term Policy for 2030, the DENSO R&D Policy Guideline adopts the worldview of 2035 to express the future that we want to realize.

Priority Development Fields

In relation to the aforementioned five elements, the DENSO R&D Policy Guideline defines priority fields that will be the focal points of development efforts.

Specifically, in the green field our priority areas are carbon neutrality, the popularization of electric vehicles, energy

management, and the circular economy, while in the peace of mind field they are automation (vehicles and *Monozukuri*) and information management.

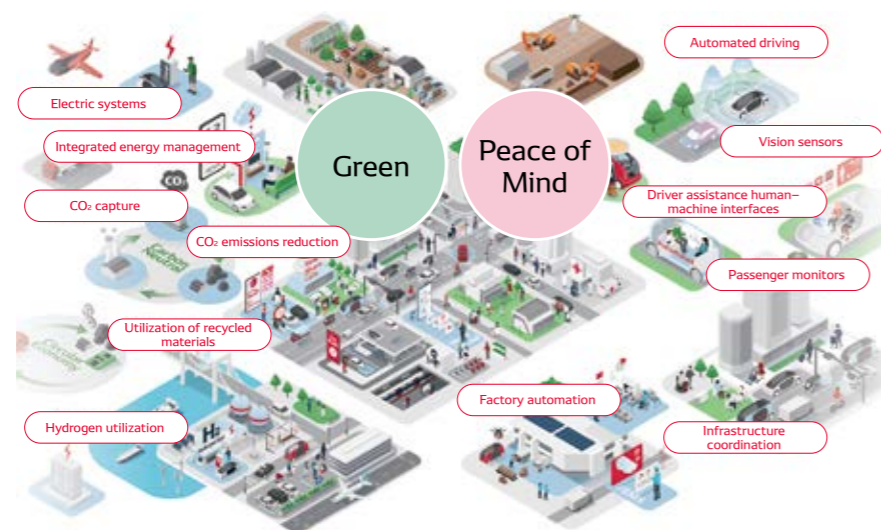
Based on the DENSO R&D Policy Guideline, we will connect academic and scientific fields with businesses and industries with a view to realizing high-value vehicles and *Monozukuri* that contribute to peace of mind, supporting the continuation of society's activities, and catering to diverse values and views of well-being.

Carbon Neutrality

To achieve carbon-neutral *Monozukuri* by 2035, we aim to achieve carbon neutrality at our approximately 130 plants worldwide. Moreover, by ensuring that society benefits from these achievements, DENSO will contribute to the realization of carbon neutrality in society as a whole. We are developing technologies for the functions that constitute energy recycling systems—such as hydrogen generation and CO₂ capture and utilization—by applying and advancing technologies originally developed for automotive components. The areas covered by these technologies include electrochemical reactions, materials, processes, sensors, and heat and energy management.

Popularization of Electric Vehicles

With a basic strategy of providing each country with the vehicle options best suited to it—which could mean BEVs, HEVs, or FCEVs—we are developing technologies focused on the three elements that are fundamental to the popularization of electric vehicles: motors, inverters, and battery management.



Carbon Neutrality and the Circular Economy

Aiming to realize a sustainable mobility society through initiatives in the three fields of vehicles, *Monozukuri*, and energy utilization

Carbon neutrality

Achieve carbon-neutral *Monozukuri* by 2035 Energy utilization

Electrification

Popularize electric vehicles Free movement of people, flow of goods

Energy management

Pursue maximum energy efficiency and effective utilization of energy

Energy utilization

Circular economy

Establish collaborations between manufacturers and recycling companies to support continuous vehicle manufacturing Minimization of resource requirements

Accident Free

Using sensors, human-machine interfaces, and ICT in combination to eliminate traffic accident fatalities and realize unrestricted mobility and to facilitate factory automation

Automation Vehicles

Establish automated driving and infrastructure coordination with a view to eliminating traffic accident fatalities by 2035 Free movement of people, flow of goods

Monozukuri

Realize *Monozukuri* that utilizes digital twins

Energy utilization, minimization of resource requirements

Information management

Establish secure data connections between vehicles and society Flow of data

For example, the development of highly efficient inverters will enable the creation of more-compact products, allow greater freedom in designs, and reduce air resistance. In addition, for next-generation silicon carbide (SiC) semiconductors, which can reduce power consumption by more than half compared to that of conventional silicon (Si) semiconductors, we will realize dramatic cost reductions by developing new manufacturing methods that extend back as far as the growth of crystals for semiconductor fabrication.

Energy Management

As they lack the heat source provided by internal combustion engines, BEVs face issues such as having insufficient heat in cold climates and reduced battery performance at low temperatures. Another issue is the cooling of high-performance computers, which are becoming even more powerful with the evolution of automated driving. To overcome these issues and thereby improve driving distance and other aspects of vehicle performance, energy management for entire vehicles is critical.

DENSO is developing energy management technologies for entire vehicles by leveraging strengths it has fostered in the fields of thermal technologies, electric drive technologies, and connected driving technologies. With its sights set on making broader contributions beyond the vehicle field, DENSO is also developing energy management based on linkage between electricity infrastructure and vehicles that optimizes energy utilization across entire towns.

Circular Economy

The objective of a circular economy is to both facilitate resource depletion countermeasures and sustain economic growth. This approach is particularly important for the future sustained growth of industry in Japan, which relies on imports for the majority of its resources.

Specifically, we will take advantage of robot and factory automation technologies, which have been fostered in *Monozukuri* activities, as well as cognitive and decision-making technologies, which have been established for advanced driver assistance and automated driving, to develop precision disassembly technologies that separate and extract used materials without waste. These disassembly technologies will provide us with high-quality, low-cost recycled materials. Further, we will build an automotive recycling ecosystem by working in partnership with recycling companies.

Automation (Vehicles and *Monozukuri*)

As Japan's population ages, the number of seniors who find traveling challenging is expected to increase. Also, due to a shortage of truck drivers, road transport may only carry three-quarters of its current freight volume by 2028. To address these issues, we will utilize our in-vehicle semiconductor technologies as well as advanced semiconductors from semiconductor manufacturers and start-ups to further heighten the performance of cameras, radar, and light detection and ranging (LiDAR) sensors and to develop supercomputer-level in-vehicle computers that are compatible with high-speed, large-scale calculations.

In the field of *Monozukuri*, DENSO will utilize its competence in factory automation and cognitive and decision-making technologies to realize robotics-based automation across society—from factories and logistics through to AgTech and systems for urban development.

Information Management

With the progress of IT, services that utilize user data are becoming ubiquitous in daily life. Similarly, in the field of vehicles, products and services that utilize vehicle control information and driver data are expanding, which is making information management indispensable. For this reason, we will pursue technological advances with a view to realizing data services. More specifically, we will develop and standardize data communications among vehicle-related products, security technologies, and in-vehicle operating system technologies that support these communications and technologies.

Regarding standardization efforts, the monitoring and disclosure of CO₂ emissions and recycled material usage of battery production is a growing global trend. Consequently, the construction of a data platform that connects manufacturers is required. Through a partnership with NTT DATA JAPAN CORPORATION, in 2022 DENSO began building a platform for standardized industry data by combining blockchain and QR Code® technologies.

R&D Resource Management

In sustaining business growth, we must conduct not only short-term development initiatives but also long-term research and early development. Over the past five years, DENSO has invested approximately ¥670 billion in leading-edge research and early development.

However, international politics and economics, industry, and technological trends have changed rapidly over the past five years. In response, DENSO has been reweighting its business portfolio by strategically shifting the focus of management resource deployment.

Comparing our current R&D expenditures in major fields with those of five years ago, we are continuing to invest in automated driving and advanced driver assistance; however, we are reducing investment in internal combustion engines while stepping up investment in electric vehicle popularization, semiconductors and sensors, new businesses, and carbon neutrality.

Going forward, while continuing to follow a basic policy that reflects its DENSO R&D Policy Guideline and priority R&D fields, DENSO will identify signs of change and undertake management resource deployment that adjusts the weighting of the business portfolio as needed. In this way, we will realize management of R&D resources that maximizes ROIC.

Changes in R&D Expenditures in Major Fields
(Fiscal 2023 versus fiscal 2019)

